Anglo-German Rivalry on Coal Markets in France, the Netherlands and Germany, 1850-1913

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1. Introduction

The rivalry between Britain and Germany as economic super-powers of that time had gained a lot of attention around 1900. Rivalry bears the connotation of being antagonistic and putting it in the words of a zero sum game it reads: What the protagonist gains the antagonist will lose. On the level of competing enterprises this equation may be correct but the customer of products in a competitive market is in most cases better off than in a monopolised or cartelised market. The case discussed here is not so much concerned with rivalry between nations but rather with the competition among coal-producing regions on third markets.

The turning from natural sources of power (water and wind) and vegetal fuels (chiefly wood) towards mineral resources (chiefly hard coal) constituted a central element of early industrialisation. Britain's leading role in industrialising her economy largely depended on the early use of hard coal as primary energy in various production processes. Several regions in Continental Europe, which industrialised later, also based their development on locally available coal resources, e.g. Wallonie and the Ruhr. But the success of industrialisation during the 19th century was not necessarily dependent on the exploitation of local mineral fuel. On the one hand traditional energy sources like water-power proved sufficient for early industrialisation (as in Switzerland), and on the other hand hard coal could be transported and stored. Thus, in regions of northern Germany, the Netherlands, or large parts of France[1] a local lack of mineral fuel deposits could be compensated for. Within the coal-mining districts entrepreneurs got more and more interested in selling their product outside of the area. With regard to the growing local demand, coal-mining tended to increase its capacity overproportionally. Due to the long gestation period it often grew in batches.[2] In the Ruhr area cartelisation helped to maintain sufficient profits, but the widely-spread strategy was to find new sales areas outside the mining districts.

After all there existed a potentially high and growing demand for mineral fuel in regions far from the coalfields, but the major obstacle to meeting this demand was high transportation costs. Coal is a bulky commodity with a low value in relation to its weight.

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1 On the significance of coal and water-power for the European industrialisation see Cameron 1985. He stresses (ibid: 5f.) that water-power was of major importance even in the mother country of industrialisation, Great Britain, until far into the second half of the 19th century. On this see especially von Tunzelmann 1978. For a preliminary and abridged version of this article see Fremdling 1989.

2 Holtfrerich 1973: 116ff.

Therefore underdeveloped transportation systems narrowly limited the market areas for coal.[3] After ocean freight rates had declined dramatically in the second half of the 19th century coal was sold world-wide on a massive scale. This situation continued for a long time so that shortly before World War I coal had become one of the most important commodities in international trade surpassed only by raw cotton and grain.[4]

During the second half of the 19th century freight rates for coal on canals, rivers and especially on railways likewise declined drastically thereby making the natural distance to the regions far away from the coalfields economically less significant.[5] Thus coal producers were capable of widening their markets. With a very high price elasticity of demand sales increased enormously in distant markets, which had been reached already previously. The spatial expansion led to overlapping markets for different coalfields and hence competition or rivalry arose among mining areas, which in former times had been pretty isolated. This competition became highly intensive in France, the Netherlands and northern parts of Germany. Although before World War I Germany had emerged as the second largest exporter of coal after Britain, she was at the same time one of the foremost importers of coal as well.[6] In northern Germany not only domestic coal- producing regions competed against each other but also foreign suppliers, namely British.

Before analysing the competition in specific market areas for coal, I will sketch the importance and direction of British coal exports in general.

2. British Coal Exports

During the 19th century Britain's coal exports[7] grew at a faster rate then her coal output. According to the recent estimate by Church British output increased from 63.5 million tons[8] of coal in 1850 to 292.1 million tons in 1913.[9] During the same years exports first comprised little more than 4 million tons and finally nearly 100 million tons.[10] Whereas in 1855 exports (7.5%) had clearly stayed behind the two most important indigenous consumers of coal, namely the iron and steel industry (24.9%) and domestic fuel (20.9%), in 1913 exports outstripped both of them, holding 34.1% as against 11.6% and 12.2% respectively.[11] Coal exports also contributed overproportionally to the growth of the entire British foreign trade. In the total domestic export value coal had comprised just

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3 Customs duties and similar taxes lost their significance in the second half of the 19th century. Therefore I deal with them only occasionally.

4 Lamartine Yates 1959: 150.

5 For an overview concerning transportation in Europe see Ville 1994.

6 Lamartine Yates (1959: 150f.) gives figures for 1913. The United Kingdom held a share of 48.6% in world exports, Germany of 22.5%. Germany absorbed 7.5% of the worldwide import volume.

7 As far as I know there is no monograph on this subject. Besides small chapters within books on British coal mining in general see the articles by Palmer 1970; Harley 1989, and the older studies by Thomas 1903; Jevons 1909 and Zimmermann 1911.

8 If not mentioned otherwise I use metric measures.

9 These and the following figures are taken from Church 1986: 19, 32, 86.

10 Coke and patent fuel are converted into coal equivalents and are included here. Bunker coal for foreign vessels in Britain and bunker coal for British vessels at foreign bunker stations are also counted as exports.

11 Slightly different figures but with the same tendency as given by Church are to be found in Mitchell 1984: 12.

1.8% in 1850, but increased to 10.2% in 1913.[12] A major cause for the enormous growth of British coal exports lay in decreasing ocean freight rates. Many British coal districts were located along the coast or were at least connected with ports through short distance railways.[13]

Harley systematically compiled freight rates of coal shipment covering a longer period. Some of his data are shown in Table 1. In addition I computed freight rates from figures collected by Thomas and Jevons (Table A1). Starting before the technically far reaching changes in ocean shipping gained momentum, Harley's data thus include the decisive transition from the wooden sailing vessel to the iron steamer. Harley registers no falling trend in the overall level of freight rates before the 1860s. Thereafter the rates declined dramatically until the early 1890s, in subsequent years they fell rather moderately and shortly before World War I they increased again.[14] In Table A1 the freight rates are taken up only during their downward trend and since then they support Harley's findings.[15] The development of coal freight rates during the 19th century differs from North's statement that general ocean freight rates already showed a downward trend in the first half of the 19th century.[16]

The steep fall in freight rates from the 1860s was due to innovations which improved the economic performance of steamers.[17] Modern iron steamers had been in use for decades, but less economically than sailing vessels. Steamers lagged behind because for a long time they had to rely on steam engines which consumed a considerable amount of coal. This had two disadvantages: first, the running costs were high and second, the coal bunkered aboard closely limited the capacity of the shipload. Not before the 1860s did the compound engine (later the triple-expansion engine and further improvements) become standard equipment of steamships. These fuel-saving devices reduced the consumption of coal considerably. Harley shows that in 1855 five pounds of coal were necessary to generate one horsepower for one hour and in 1890 less than two pounds sufficed to generate the same power.[18] The fuel-saving effect directly lowered the running costs and indirectly increased the freight-earning capacity, which was further enlarged through the smaller dimensions of the improved steam engines.

The steamship itself was decisive in increasing British coal exports. Through forward linkage effects, i.e. decreasing freight rates (caused by the very steamship), the sale of British coal was promoted on foreign markets. To reach these markets powerful backward linkage effects were induced, because this means of transportation itself consumed coal. In 1905 about 17 million tons of coal were bunkered in British ports. And a contemporary

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12 Based on the figures in Mitchell/Deane 1962: 283f., 303, 305. Bunker coal for foreign vessels in British ports is not included. In 1913 this comprised 25% of the remaining exports of coal after all.

13 See the map in Church 1986: XXI.

14 Harley 1989: 315ff.

15 See also Jevons (1915: 692f.), who compiled data for eight ports from 1863/65 up to 1913 (yearly data without gaps from 1886 onwards). They also reveal the described trend.

16 See also Harley 1988 and North 1971: 163-174.

17 Only a few aspects of technological improvements are sketched here. For more information see Dyos/Aldcroft 1969: 254ff.; Harley 1971: 216 ff.; Ville 1990: 49 ff.

18 Harley 1971: 220.

maintained before the Coal Supply Commission that in the same year at least 5 million tons of coal were shipped to foreign bunker stations.[19] This means that nearly one third of the coal leaving Great Britain on sea was used for running sea shipment.[20] From this demand Welsh steamcoal profited extraordinarily. Besides other qualities it was dowered with a higher density and thus required less storage capacity.[21] In 1850 the coal leaving the Bristol channel had made up just 12.5% of all exported coal, but in 1913 its share comprised 41.8%.[22]It is often argued that the coal freight rates could only be so low because they were based on a mixed calculation. And the low rates alone should have guaranteed Britain's merchant fleet the use of its otherwise excessive capacity for return freight. Precisely this argument is examined by Harley with the following conclusion:[23] The great success of the British merchant fleet in non-European trade was not even partly due to coal transportation. The shipment of coal into non-European regions was comparatively very small.[24] Table 2 confirms that this trade was concentrated on Europe.

According to Harley the traffic with foreign North Sea and Channel ports was carried out with special ships, which had to earn their money alone from coal transportation. A different case, however, was the shipment to Scandinavia and to the Baltic Sea: as transportation of timber formed the major source of income, the return freight for coal merely had to defray marginal costs. In the Mediterranean area the coal freights covered the bulk of the receipts, with grain transported as return cargo not having to bear the entire costs of the back and forth journey. In any case it might be stated that the tendency towards downward and finally low freight rates made British coal more and more competitive on foreign markets. In particular so since (disregarding cyclical fluctuations) British coal prices at the pit mouth rather stagnated from the 1850s to the 1880s and increased[25] even thereafter.

How were the British coal exports distributed among the receiving countries or regions? To my knowledge the secondary literature deals with this subject in a rather crude manner.[26] Therefore basic data had to be compiled making fundamental use of the British foreign trade statistics. I assembled yearly data on the British coal and coke export for each destination, disregarding both the figures on patent fuel and on bunkers for foreign vessels in Britain. The regional distribution of exports is determined by the receiving port. Table 2 shows the already mentioned dominance of European customers. Between 1853 and 1913 this preponderance even increased: initially the European share made up about

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19 Church 1986: 34.

20 In 1905 hard coal exports (without coke, patent fuel, bunkers) were about 48 million tons. Source: see Table 2. Thomas even estimated that this share was more than 50%. Thomas 1903: 469; See also Palmer 1970: 337 ff.

21 Church 1986: 33; Palmer 1970: 336, 340.

22 Church 1986: 35.

23 Harley 1989: pass. This argument is set forward e.g. by Crouzet, who points out that 80% of the weight of British exports consisted of coal. Crouzet 1978: 236; see also Zimmermann 1911: 1225, 1261ff.

24 South-America alone played a significant role.

25 See the graph in Church 1986: 53. A similar tendency occurred in Ruhr coal mining, see Holtfrerich 1973: 20.

26 See, however, Harley 1989. He compiled yearly data between 1850 and 1993, broken down to only seven destinations, i.e. the major shipping routes.

70%. During the 1870s and around 1900 it took two further upward batches of 5% percentage points. Finally Europe got about 80% of all British coal exports. Outside of Europe large amounts were sent to Egypt, which was due to the opening of the Suez-Canal in 1869. This canal helped to diffuse the innovation of steamships to the Far East.[27] It seems likely that coal exports to the rest of Africa mainly served to supply bunker stations. Initially, i.e. in 1853/57, Turkey was an important customer, but the then decreasing export shares seem to indicate an economic stagnation in this area. India took a high level until the 1880s, but like the rest of Africa, it received rather modest shares in the following decades. The local demand was increasingly met by supplies of newly explored coal mines in the regions themselves. The same applies to South Africa and Australia.[28] Until the 1860s the shares of North America are surprisingly high, but through improved transportation systems there the wealthy indigenous coal resources could soon better be distributed to other North American regions. As in Latin America, rich coal basins had not been explored or exploited before World War I and British coal could then gain important sales in spite of high transportation costs.[29]

The significance of single countries in Europe and the shifting export ratios over time actually require a differentiated analysis. One might expect countries poorly endowed with coal resources but blessed with a long coast line to have offered an ideal sales market for British coal. Denmark, with her constantly high shares, lends strong support to this. But the shares of Sweden/Norway and above all Italy jumped too high to be fully explained by this hypothesis. The demand for coal depended on the stage of development, i.e. the timing of entering into industrialisation, which mainly was characterised by applying coal consuming techniques. Hence the shares of British coal exports to the various European countries shifted considerably.[30] France and the Netherlands, serving as contrasting example of coal imports from Britain, are dealt with separately. The high Russian and the huge German shares point to a further factor of influence. Both Russia and Germany possessed enormous indigenous coal resources. But for a long time it was cheaper for locations near the coast to import British coal than to rely on domestic supplies. So these British sales were protected against domestic competition by high costs for overland transportation. Up to World War I British coal remained competitive in coastal markets in spite of the then decreasing railway freight rates.

Finally a remark on quality differences concerning coal is in order. Quality had a great influence on the market chances of this commodity. Coal is not at all a homogeneous product, but rather a general term. The comparison of Jevons is striking: "'Coal' to the uninitiated means something pretty definite, but to the dealer in coal it is only the name of a whole class of substances, and, without further qualifications, means about as much as the words 'cloth' or 'paper'". Different coal qualities influenced considerably the spatial dimension of sales markets within certain pricing marges independent of other causes.

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27 See Farnie 1969: pass.; Harley 1971: 223 ff.

28 See Jevons 1915: 783ff.; Hassel 1905: 175 ff; Zimmermann 1911: 1150; Palmer 1970: 339.

29 Jevons 1915: 782f.; Hassel 1905: 36ff.

30 Alternative domestic sources of energy should also be considered, e.g. the richness in wood in the case of Sweden. See Hassel 1905: 122ff.

The British perspective alone is not sufficient to explain the direction and significance of British coal exports. Characteristics of the receiving markets have to be considered as well, which is attempted for France, the Netherlands and northern Germany.

3. France

Table 2 proves France to have been the major customer of British hard-coal exports from the middle of the 19th century until 1913. In the west and southwest of France it was much cheaper to import coal from Britain than to buy it from indigenous coalfields.[31] Although France had drawn on British coal resources already since the 16th century, a major set-back occurred during the Napoleonic Wars and the subsequent period of Restauration: War time prohibition and later high differential tariffs discriminating against Britain withheld British coal from the French market. This changed between 1834 and 1837 when import duties on British coal were lowered considerably. The abolition of the British export duty followed in steps until 1850, and France for her part lowered her import duties further in 1853, 1860, and 1863. This clearing away of customs barriers stimulated the importation of British coal into France.[32]

In the long run, British coal exports to France gained higher market shares than those of Belgium and Germany, rising from 20 to 25% in the middle of the 19th century to half of all French coal imports in 1913. Whereas British coal had initially made up roughly ten per cent of the domestic consumption it comprised nearly 20 per cent of it shortly before World War I (see Table 3). Crouzet marks off two different stages in the position of British coal on the French market. After rapid gains in the 1830s the market share remained rather stable until 1865 (first stage) followed by large increases (second stage). There are several reasons for the development during the second stage: since the 1870s British coal prices declined as well as the rates of freight across the Channel and within France.[33] Ceding Alsace-Lorraine to Germany, France underwent drastic changes in her foreign trade balance on coal. Belgian coal exports to France stagnated relatively from 1866 onwards and declined after 1883. Coal from Belgium made up the following percentages of total French coal imports: 1834 83%, 1866 60%, 1889 50%, 1901 36%, 1913 20%. The Belgian coal could not fully compete with the coal from the new French mines in the Départements Nord and Pas-de-Calais. This indigenous coal penetrated mainly into the traditional Belgian market in France leaving the British unmolested. Since the July-Monarchy Britain had gained more and more former Belgian sales areas. Initially she supplied the French Atlantic ports, and under the Second Empire Basse-Seine, Calais and Boulogne supervened.

During the last third of the 19th century British and Belgian sales areas barely continued to overlap, with the important exception of the Paris region. But it was not

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31 For the following remarks I draw exclusively on Crouzet 1978. Otherwise this is indicated by a special footnote.

32 The duty finally made up only 10 per cent of the import value.

33 For coal prices see Mitchell 1984: 273ff. From the 1890s, however, the trend was reversed, i.e. the prices increased. For freight rates see Tables 1, A1 and Merger 1995.

before 1894 that British coal finally exceeded Belgian coal on the French market. Another reason for the partial retreat of Belgian coal from the French market was probably the rapid industrial development in Belgium itself. It even forced Belgium to import German and partly British coal via the Netherlands (see Table 5). After 1901 the British market share in France grew less because of the increase of German exports. The German market share in France increased from 12% in 1900 to 27% in 1913. Most of the German coal designed for the metal industry in Lorraine did not compete with British coal in its sales areas directly, but the dynamic price and marketing policy of the Rheinisch-Westfälische Kohlensyndikat produced a successful coal export trade via the Rhine and Rotterdam. In the end German coal even arrived at French ports such as Boulogne, Rouen, Saint-Nazaire, la Rochelle and Bayon. Coal from Germany sometimes held considerable shares in certain coastal départements,[34] but by and large Crouzet concludes that the British market position was never seriously undermined by German coal exports to France.

If the total imports of British coal are broken down to different regions of consumption over time a differentiated picture appears (see Table 4). In the coastal regions between the Somme and the Bidassoa British coal held its strongest market position in the long run. In 1838 the 14 départements of Maritime Normandy, Brittany, and Maritime South-West received 66% of their supplies from Britain. Small local coalfields covered the rest of the consumption. But local supply could not satisfy the increasing demand, thus the British share increased considerably during the second half of the 19th century: 1867 80%, 1883 88%, 1892 82%, and 1900 88%. Thereafter British coal lost a bit to German, Belgian and French coal, so that in 1911 its share had dropped to 75%.

But in two coastal regions British supplies never dominated the market. The first was Pas-de-Calais north of the Somme, where local and Belgian supplies met most of the demand. The second was Bouches-du-Rhône, including Marseille. During the July-Monarchy and at the beginning of the Second Empire only modest quantities of British coal were used here, in 1847 they made up 15% of the coal consumed in this region. After 1858 British coal had to face vivid competition from coal of the mines in Gard and Hérault. During the 1860s cheap railway transportation put the French coal in the way of pushing the British nearly off this market. Thereafter declining ocean freight rates led to a recovery and finally to an even stronger position of British coal on this market.

Except for markets accessible via navigable rivers British coal had hardly penetrated into interior French regions. This changed during the Second Empire when railway construction boomed. Lower overland transportation costs helped both British and French coal to widen their markets. In general British coal increased its market shares not before the last third of the 19th century. Still higher shares were achieved at the beginning of the 20th century. But in some upcountry regions British coal held a strong position. For example in interior and Central West, which both had good connections to ports, but were accessible to French coal only on secondary railway lines. Moreover those were built rather belated. The Paris region being the most important interior place of consumption had

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[34] In 1911 seven of these départements imported 2 641000 tons of British and 580 000 tons of German coal.

always been an important sales area for Britain.[35] In 1911 it absorbed 20% of the British coal consumed in France. In the remaining French regions, also in those not mentioned in Table 4, British coal appeared rather sporadic, if at all. The vicinity to French or even Belgian and German mining areas kept British coal out of the centre, the east, the greatest part of the south-east and from the north with the exception of Pas-de-Calais.

On the one hand, Crouzet concludes that British coal supported the industrial development in, for instance, Basse-Seine and Basse-Loire because it was cheaper there than French coal. On the other hand, transportation costs made imported British coal significantly dearer than on the other side of the Channel and than French coal in the mining districts themselves. This may partly explain why vast regions in spite of importing British coal, succeeded less well in industrialising themselves.

4. The Netherlands

Until recently the timing and nature of the Dutch economic development during the 19th century had remained rather obscure. Its periodisation depends on statistical information on the basic economic data, which are being collected within the framework of national accounts since the last decade. The project on "Reconstruction of National Accounts for the Netherlands in the 19th Century" is supervised by van Zanden and partly by myself. It is organised around a number of Ph-D theses.[36] The quantitative framework, which is now coming to light, will surely clarify the discussion concerning the Dutch way into the 20th century. As yet the discussion had been confused by the use of different concepts of periodisation: Brugmans placed the "Industriële Revolutie" between 1850 and 1870, de Jonge identified the Dutch "take-off" from 1890 or 1895 to 1910, and van Zanden placed the beginning of the process of "moderne economische groei" in the years between 1850 and 1880. In a broader study Maddison included the Netherlands in the group of countries which were involved in a process of "substantial and sustained growth" (measured in gross domestic product per capita) since 1820.[37]

Although the evidence is now becoming more conclusive, most scholars might still agree on labelling the Netherlands as a late-comer concerning an important part of economic development, namely industrialisation. And this retarded industrialisation has often been explained by the lack of domestic sources of raw materials such as hard coal.[38] It is true that the exploitation of domestic coalfields in Limburg did not take off earlier than the turn of the 20th century. Before World War I the rapidly expanding domestic supply of hard coal hardly covered one fifth of domestic consumption.[39]

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35 Merger 1995: 205 ff.

36 Already published are the following: Knibbe 1993; van der Voort 1994; Groote 1995; Horlings 1995 and Smits 1995 (forthcoming).

37 See Brugmans 1983: 201 ff.; de Jonge 1976: 236 ff., 343 ff.; van Zanden 1987: 64 ff.; Maddison 1982: 43 ff., 166; van Zanden 1989: 17 ff.; van Zanden 1995.

38 Bos (1987: 111) quotes van Dillen and Brugmans as advocates of this view. He also mentions Wieringa who places only secondary importance to the lack of domestic raw materials. See Brugmans 1983: 213. Furthermore see Griffiths 1979: 75ff; Kreeft 1988: 219, 225 ff.; Van Zanden 1995: 61.

39 Bos 1978: 111.

The high consumption of imported coal, however, severely weakens the argument that Dutch industrialisation should have been hindered by lack of domestic raw material supplies. Even before the railway age the Netherlands had a highly developed system of inland water transportation (rivers and canals) and could thus draw on coal supplies from neighbouring countries[40]. With regard to the transportation costs for coal, the major Dutch cities were in a better location than for example Berlin, which industrialised early and very rapidly during the 19th century.[41] Thus, an explanation of the retarded industrialisation in the Netherlands should not take the lack of domestically available coal resources into account. Rather, the argument should be reversed to ask why the Netherlands did not make more use of foreign coal supplies in order to adopt coal-concerning technologies than they actually did.[42] But as speculation on this doubtlessly useful question extends beyond the scope of this article, I will restrict myself to the facts on coal supplies to the Netherlands.

As shown by the figures in Table 2 the Netherlands were a rather moderate importer of British coal, though not insignificant for British exporters. They could not dominate this nearby market because the Belgian coal mines lay in the close vicinity and above all because Ruhr coal had such an easy access to the Dutch market. Since the middle of the 19th century German suppliers of coal were freed from artificial trade barriers, such as the different import duties, navigation laws, and river tolls.[43] Drawing on figures calculated by Nusteling the Netherlands imported hard coal from the following countries:[44]

Year	from Germany %	from Great Britain %	from Belgium %
1850	29	33	38
1855	46	32	22
1860	51	31	18
1865	66	16	18
1870	65	22	13

40 For a review of the literature on this subject see de Jong 1992. Although he labels the quality of the waterway network to be "poor", he nevertheless concludes: "The limitations of this system did not hamper or frustrate the economic process of industrialisation in the country" (de Jong 1992: 19). Recent studies of the Dutch transportation system, however, clearly reveal that the major improvements of transport infrastructure were made in the third quarter of the 19th century. See Clement 1994, Groote 1995 and Niemeijer 1995.

41 In fact some regions, e.g. Twente, had to wait for railway connections in order to get better access to foreign coal supplies. And a national railway network emerged rather late in the Netherlands, indeed. But from an international perspective, de Jonge and Bos are wrong when they see the Netherlands as badly suited for internal communication before the 1880s. See Bos 1978: 112ff. On the development of the Dutch transportation system see Brugmans 1983: 226 ff.; Clement 1994; Groote 1995. The careful assessment of the Dutch transportation problem in the first half of the 19th century by Griffiths (1979: 66ff.) can be seen as inconsistent with his conclusion. Thus this assessment and similarly the one by Kreeft (1988: 226 ff.) rather support my argument. It depends on the yardstick for comparison: As compared to Britain or Belgium the Dutch transportation system and hence fuel costs were at a clear disadvantage, but not in the least so as compared to regions in the south, the middle and the north of Germany. And those "handicapped" regions were successfully industrialising, after all.

42 To some extent this is discussed now by van Zanden 1995: 58 ff.

43 Nusteling 1974: 174ff.

44 Nusteling 1974: 174.

Up to the decade around 1890 the British share declined under 10 per cent. In the following years the share first increased, but shortly before World War I it again dropped below the 10 per cent level. The overwhelming winner was the mining industry at the Ruhr (see Table 5).[45]

It is much more difficult to explain the thus far roughly described long-term trends of the Dutch coal market. Production prices at the pit mouths abroad only had influence on short-term fluctuations of the different market shares.[46] The crucial points were transportation and related costs. Although one might suppose water transport to be cheaper than railway transport, there were considerable advantages for the railways. From Duisburg or Ruhrort to Rotterdam shipping was always cheaper, but this was not the case with haulage to Amsterdam. Here the costs were forced up by the transportation from the coal mine to the Rhine. As the river Ruhr was hardly navigable for large coalships, railways had to transport the coal from the mines to the Rhine harbours. Furthermore, with differential tariffs set very high for short haulage distances, the railway favoured direct transportation to the Netherlands by rail.[47] Loss of quality through trans-shipping and inadequate facilities for shipment on waterways helped railways maintain an advantage over waterway transportation from the Ruhr to the Netherlands. But this changed after the turn of the century: freight rates on railways did not go down although those on waterways did. Trans-shipping facilities in Rotterdam were much improved and larger vessels lowered transportation costs as well. As a consequence much more coal was brought to the Netherlands by waterway.[48] Shortly before World War I an increasing quantity of Ruhr coal reaching Rotterdam was even bound for overseas markets.[49]

To sum up, Belgium played a minor role in the Dutch coal market. Since production there could not even meet the internal demand, Belgium herself had to import large quantities.[50] It is true that the Rheinisch-Westfälische Kohlensyndikat occasionally dumped large quantities of coal on the Dutch market whenever exposed to unfavourable conditions in Germany. But on the other hand the same cartel even imported British coal via the Rhine whenever domestic coal did not suffice to fulfil long term contracts in boom periods.[51] The dominance of Ruhr coal on the Dutch market was mainly due to lower transportation costs (and related costs) as compared with those of coal from British mines. After losing its initially strong position British coal by and large served as nothing more than a stopgap for the Dutch market.[52]

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45 On an average about 10% of Ruhr coal output were sent to the Netherlands, Nusteling 1974: 173.

46 Bos 1978: 123.

47 The breakthrough for coal transportation to the Netherlands on railways occurred between 1867 and 1875. See Nusteling 1974: 176.

48 Nusteling 1974: 288.

49 Nusteling 1974: 289; Bos 1978: 138ff.

50 See Table 5. A large part of alleged Dutch imports from Belgium consisted of mere trans-shipments from Belgian coalfields to other parts of Belgium. Bos 1978: 119.

51 Nusteling 1974: 287; Bos 1978: 135.

52 See also Bos (1978: 116ff.). Going into more details than Nusteling, Bos discusses the position of British coal on the Dutch market. The stopgap function of British coal becomes very clear since the 1880s (see ibid: 125ff.). But according to Bos (ibid: 132ff.) Britain had even lost this function by 1909.

5. Northern Germany

5.1 Regional Development of Coal Output and Foreign Trade

In 1850 the Prussian mining districts alone produced more than 82% of Germany's[53] hard coal output. And to the total German production of more than 5 million tons Silesia contributed 28.5%, Westphalia 32.9%, and the Rhineland 20.1%. Apart from Prussia only the Kingdom of Saxony achieved a remarkable output reaching 12.6%. Small shares came from Bavaria (2.5%) Electorate Hesse (2.6%) and Hanover (0.9%). The remaining mining districts were neglectable.[54] Table 6 shows the enormously growing total production with the shares of different coalfields until World War I. The Lower Rhenish-Westphalian district, i.e. the Ruhr, mounted to predominance. Upper Silesia also gained a little, whereas all other districts relatively declined.[55]

The output of brown coal (lignite) was less important than hard coal. The brown coal mining fields were favourably scattered over Germany, whereas hard coal was concentrated on boarder regions. Rich brown coal resources were exploited in the middle of Germany. The output of brown coal grew also remarkably during the second half of the 19th century developing from 2.4 million tons (1853) to 40 millions (1900) and 67 millions (1910). Germany both exported and imported coal with the export of hard coal considerably outstripping the import most of the time. By using two ratios the significance of foreign trade may be demonstrated. Hard coal export (X) is expressed in per cent of production (P) and imports (M) are expressed in per cent of consumption (C).[56]

Year	$\frac{X}{P}$	$\frac{M}{C}$
1850	9.9	8.3
1860	14.4	6.6
1872	17.4	7.6
1881	15.3	4.5
1890	13.0	6.4
1900	14.0	7.3
1912	17.8	6.7

German exports were concentrated on neighbouring countries. Shortly before World War I Austria-Hungary was the most important customer followed by the Netherlands, Belgium, France, Russia, Switzerland and Italy. The major exporter of hard coal to Germany was all the time Great Britain. Exports of brown coal played a minor role. Imports,

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53 That is the area which later formed the German Empire without Alsace-Lorraine.

54 Viebahn 1862: 362 ff.

55 Viebahn 1862: 367 ff.; Vierteljahrshefte 1901: II.9.f.; Statistisches Jahrbuch 1912: 92.

56 The calculations are based on the following sources: On production see Table 6, for 1850 see Fischer et al. 1982: 63. On foreign trade see Statistisches Handbuch 1907: 471, 393 ff.; Statistisches Jahrbuch 1915: 202. Foreign trade of coke and patent fuel is neglected.

however, which nearly exclusively came from Bohemia, constituted for some time a major part of German consumption, amounting from 5% (1866), to 24.9% (1891), 16.5% (1900) and 7.4% (1913).[57] After 1890 the import quotas dropped because the brown coal resources in the middle of Germany and in the Rhineland were then being exploited heavily.[58]

In order to explain regional variations in the development of output and the changing position of foreign coal in Germany a number of influences has to be taken into account. Besides supply side factors, which determined the cost and price levels within the mining districts, there were demand side factors. In the mining regions the output was increasing to meet the growing demand of coal consuming industries, of which the iron and steel industry was by far the most important.[59] The close connection between local coal consuming industries only partly explains the demand induced growth of output and the changing importance of particular mining districts over time. In addition, sales opportunities outside these areas should be analysed. And these changed fundamentally in the late 1850s when drastically cheapened overland transportation allowed massive coal sales to regions far away from mining areas.

5.2 Transportation Costs within Germany

Freight rates on rivers and canals fell from the middle of the 19th century up to World War I because of pressure from competing railways and improvements in shipbuilding and the infrastructure in general. This tendency was enhanced by the abolition of river tolls in the 1860s. Until about 1880 railways lowered their freight rates probably faster than inland waterways, but the position then changed so that by the beginning of the 20th century the freight rates for bulky commodities on water were about half those of the railways.[60] On the freight rates of coal transportation on inland waterways I have not yet gathered much information. Large cargoes of coal shipped on the Rhine from Ruhrort to Mannheim had to bear about 6 mark in 1854 and 2.70 mark per ton around 1900.[61] More important for the regions treated here was the development of freight rates on rivers and canals in northern parts of Germany. On the Weser between Bremen and Minden the rates declined from 17.40 mark in 1853 to about 7 mark per ton in 1900.[62] Shipments on the Elbe were liable to high river tolls until 1866, which could double the freight rates from Hamburg to Magdeburg. As shipments on the Oder were free from any river tolls certain

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57 Calculations are based on Fischer et al. 1982: 65; Statistisches Handbuch 1907: 459; Vierteljahrshefte 1901: II.10f.; Statistisches Jahrbuch 1915: 202; ibid 1929: 298. Foreign trade of patent fuel is neglected. See also Randhahn 1908: 89. According to his yearly figures Bohemian coal reached its highest share of 25.5% in 1890.

58 Calwer 1914: 98f., 102f.; see also Zickert 1907.

59 See figures in Holtfrerich 1973: 139 ff.; Krengel 1983: 131 ff.; for a general assessment of Germany's inland navigation, see now Kunz 1995.

60 Huber 1978: 161 ff.

61 Entwickelung 1904: 112 f. The figure for 1854 is not well documented, and for 1900 the rate varied between 1.70 and 6.10 mark per ton. On May 28, 1910, the rate amounted to 1.25 mark per ton, Sonndorfer/Ottel 1912: appendix 3.

62 Rauers 1913: 85, 97.

commodities were cheaper to transport to Magdeburg (Elbe) via Stettin (Oder, canals, minor rivers) than via Hamburg (Elbe).[63] But in the long run freight rates on the Elbe declined.[64] Table 7 shows a downward trend for coal freight rates from Hamburg to Berlin between 1898 and 1909. In real terms the abatement was even more pronounced since the general price level rose at that time.

The freight rates on the rivers Elbe and Havel were highly decisive for the competitive position of British coal in Berlin.[65] This coal, however, could also reach Berlin via Stettin (Oder, Finowcanal, upper Havel). Rather narrow, the Finowcanal proved to be a severe bottleneck. That is why Hamburg improved on its transloading function for British coal destined for Berlin.[66] To compensate Stettin for the disadvantage a new connecting canal to Berlin was built, which, however, was not opened before 1914.[67]

At first sight one might expect Silesian coal to have profited from the Oder for long distance haulage. The more so as a 17th century canal together with the Spree gave access to Berlin.[68] But extremely irregular waterlevels often made the Oder unnavigable. Heavy investments for regulating and canalising the river since the 1870s only partly solved this basic problem. Furthermore the Oder does not lead along the coalfields in Silesia directly and the connecting Klodnitzcanal, built at the end of the 18th century, was far too narrow and thus only of minor importance. If coal was shipped on the Oder at all it reached that river in general by rail.

In the middle of the 19th century the freight rate for Upper Silesian coal shipped to Berlin on waterway came to 27 - 29 mark per ton. This was ten times as high as the freight from Breslau-Pöpelwitz (upper Oder) in 1895.[69] The rates from Breslau to Berlin compiled by Zentgraf (Table 7) indicate a decline since 1892. But Kosel as the main place for transloading shows no downward trend. Under normal conditions the waterway was the best means of shipping Silesian coal indeed. But unfortunately the basic shortcomings of the Oder did not allow a regular and thus planned traffic.

For the sale of Westphalian coal in northern Germany inland water navigation was not too significant. The Dortmund-Ems canal (fully opened in 1899) was mainly built to improve the Ruhr coal sales in northern Germany and to drive British coal away from German ports.[70] And in fact hard coal did become the bulk of the cargo into northern direction.[71] But for the entire north-western part of Germany the canal was of rather limited importance, as Ruhr coal entrepreneurs preferred to send their coal to Hamburg by train.

The development of freight rates overland was decisive in gaining new distant

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63 Fischer 1907: 16, 62, 73 ff.
64 Fischer 1907: 94 ff. 184 ff. Unfortunately he gives no figures on coal transportation.
65 This held true for Bohemian coal as well.
66 Zentgraf 1913: 458 f.
67 Mewes 1937: 59 f.
68 On the following points, see Zentgraf 1913: 456 ff.
69 Berlin 1896: 356.
70 von Nördling 1885: 155; Meitzen 1884: 25 ff.
71 Entwickelung 1904: 85 f.; Verkehr 1912: P. 1 35.

markets in northern Germany. And the only means of transport up there was the railway.[72] Such a railway connection, however, did not immediately entail cheap coal haulage over long distances. Berlin for example was connected with both the mining districts of the Ruhr and Upper Silesia already since 1847, but at that time alone British coal reached this market, and this was transported on waterways.[73]

In general high freight rates were responsible for the delayed start of coal transports on railways. In the 1840s railways charged between 11 and 14 pfennig[74] per ton kilometre.[75] This meant a doubling of the price of coal after a distance of 38 to 50 kilometres.[76] Such a tariff destroyed any attempt to compete against British coal in large parts of northern Germany. From Britain the coal arrived cheaply over the North Sea and inland waterways.[77] Since in the long run German coal prices at the pit mouth either stagnated or even increased, the only chance for German coal to enter into competition in northern Germany lay in lower transportation costs of the railway.[78] But up to the early 1850s the level of freight rates did not allow any significant coal transportation on rail. Only a successful campaign for the introduction of the "Einpfennigtarif"[79] (i.e. a special low rate for coal transportation of 2.2 pfennig per ton kilometre) helped to surmount this obstacle.[80] The special tariff was originally designed to make Upper Silesian coal competitive on the Berlin market, and the price differential between British coal in Berlin and Upper-Silesian coal at the pit head determined the rate. Special trains had delivered domestic coal to Berlin as soon as in 1849. Political pressure compelled the Upper Silesian Railway Company to keep those special trains with this special tariff running regularly from 1852 onwards. That is to say the Prussian Minister of Trade threatened to run state-owned trains along the company's network - an action allowable under the legislation of 1838, but never actually implemented.[81] The introduction of the special rate for coal transportation, the "Einpfennigtarif", from Upper Silesia to Berlin served as a model for the demand of colliery owners in other mining areas, such as the Ruhr. Although their demand was supported both by public opinion and by state authorities, it was, nevertheless, the increasing profits - due to economies of scale - which really prompted private railway companies to cut their freight rates. A high price elasticity of demand for coal influenced its transportation considerably. Slightly falling prices outside the mining areas in the 1860s were not the only factor behind the expansion of the coal market. Railways also transported coal to places which formerly had been excluded from supplies - hence they created new markets. Between 1860 and 1862 this special tariff was conceded on all

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72 Carriage by horse and cart was no alternative. Around 1840 this led to a doubling of the price of coal already after a ride of 13.5 kilometres. Fremdling 1979: 216.

73 Berlin 1896: 149.

74 These are always "pfennigs" of the "Mark"-currency, not of the "Taler"-currency.

75 Ulrich 1891: 58; Engel 1879: 141, 146.

76 This calculation is based on a coal price of 5 mark at the pit mouth. Holtfrerich 1973: 22.

77 Holtfrerich 1973: 20 f.; Jacobs/Richter 1935: 62 f.

78 There was no debate on introducing special import tariffs.

79 This was one "Pfennig" of the "Taler"-currency per "Zentnermeile", which meant 2.2 pfennig of the "Mark"-currency per ton kilometre.

80 See Bloemers 1966; Martini 1890.

81 Concerning the regulation of the Prussian railway see Fremdling/Knieps 1993.

important northern German lines, but it was in force only on special trains.[82] The tariff on shorter distances had not been lowered this much. Therefore the actual receipts the railways got from coal transportation were still higher than the "Einpfennigtarif". Hence on Prussian railways the average freight rate per ton kilometre amounted to 4.7 pfennig in 1858, 4.1 in 1862, 3.9 in 1863, and 3.2 in 1872.[83] In 1877 the "Einpfennigtarif" became the norm for distances over 100 kilometres. In subsequent years even lower rates were charged on very long distances or to ports.[84] This reduction led to the curious consequence that around the turn of the century huge amounts of coal were sent to Hamburg by train to be transloaded there into ships for Berlin.[85]

Coal shipments thus reacted very sensitive on changes in transport costs. Thus the opportunities of mining areas on distant markets were closely dependent on changes in freight rates. And with tariff reductions on the railway German coal was enabled to seize large market shares in many regions of northern Germany.

5.3 Local Coal Markets in Northern Germany

By way of example, three important markets are chosen to demonstrate the competition among different German and foreign suppliers of coal. These are Hamburg, Magdeburg and Berlin.[86]

5.3.1 Hamburg

Hamburg was by far the most important port of entry for British coal into the German market.[87] This was not only due to local consumption but also to the fact that British coal was transloaded there and shipped to other German destinations on the river Elbe and her tributaries. Between 1858 and 1870 the British export statistics kept separate figures for Hamburg. Of all British coal exports to German ports Hamburg clearly received more then 40%, and in 1869/70 the share was even above 50%.[88] Until the 1870s German coal had hardly any chance on the Hamburg market.[89] At that time British coal came mainly from Newcastle or Cardiff. In the beginning it was transported on sailing vessels, which were rapidly replaced by modern steamships from the 1860s. Already in 1866 more coal reached Hamburg by steamships than by sailing vessels.[90]

Various quantitative evidence reveals an overwhelming preponderance of British coal and in the years from 1851 to 1865 the proportion of non-British coal in Hamburg was

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82 Erläuterungen 1862: 5, 22; Engel 1879: 141.
83 Complete data in Fremdling 1985: 69.
84 Preussische Landeseisenbahnrat 1908: 39 ff.; Stuber 1968: 50-61.
85 Entwickelung 1904: 157 f.
86 For a more detailed analysis see Fremdling 1989.
87 See now Lyth 1995: 16 f.
88 Source: see footnote for Table 2. Only in 1865 did Hamburg's share drop below 40%.
89 Hamburgs Handel 1897: 241; Heidmann 1897: 5.
90 Hamburgs Handel 1897: 240 f.

below 1%. Even in 1864 (when Denmark for some time blocked German ports and miners in Britain were on strike) the non-British share came only to 1.1%.[91] The following table is taken from the statistics compiled by the Prussian Minister for Trade:[92]

Year	1860	1862	1865	1871	1881
Import of British coal (%)	100.0	98.2	99.8	99.2	67.8
Total imports (1000 tons)	505.5	614.9	603.3	1145.9	1485.9
Share consumed in Hamburg (%)	50.6	66.3	70.8	49.8	74.0

The preponderance of British coal fell in the middle of the 1870s when special tariffs on the railway allowed increasing quantities of Westphalian coal to reach Hamburg:[93] 1875 60 000 tons, 1880 340 000 tons, and 1881 460 000 tons. Hamburg became the place for competition among different mining areas and among different transportion systems as well. British coal came as usual by ship, Ruhr coal by railway. Other smaller competitors reached Hamburg like this: Bohemian brown coal by ship on the Elbe, indigenous brown coal as well as hard coal from Hanover and Osnabrück by railway.[94] The bulk of the coal coming to Hamburg was consumed there. The shares given above reveal no clear-cut trend. The high share of local consumption in 1881 coinciding with large quantities of Westphalian coal sent to Hamburg probably indicates that British coal had already lost shares on other German markets depending on Hamburg. Detailed information for the 1860s shows that these dependent markets, which mainly lay in Prussia, took more than 80% of the British coal transshipped in Hamburg. Small quantities (1-2%) of the British coal were even shipped to Saxony and Bohemia, and the remaining part went to Anhalt, Hanover, Mecklenburg, Lauenburg and Lübeck.[95] The bulk of British coal was sent on to Prussia on the following rivers: Havel and Spree (1862) 50% and (1865) 60%; Saale 9% and 5% respectively; Elbe 41% and 36% respectively.[96] This identifies the regions of Magdeburg and Berlin as being the very centres of British coal sales.

Since the late 1870s more and more Ruhr coal reached Hamburg so that the British market share had shrunk considerably in 1881, and in particular segments British suppliers were nearly driven out of the market entirely. In the middle of the 1890s the bituminous coal, for example, which formerly was supplied from South Wales, now came almost exclusively from Westphalia. It was used for large boiler installations, especially ship engines. The market for semi-bituminous coal was divided, whereas British suppliers still

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91 Erläuterungen 1865: 71; Entwickelung 1904: 185.

92 Erläuterungen 1860: 29; 1862: 43; 1865: 54, 1871: 41; 1881: 46. In this source the non-British shares are a little bit higher.

93 Heidmann 1897: 16.

94 Erläuterungen 1865: 71; Entwickelung 1904: 185.

95 Erläuterungen 1862: 43; 1865: 54.

96 Erläuterungen 1865: 72.

dominated the market for gas and house coals.[97] In 1890 Westphalian colliery owners even established their own marketing organisation for detail trade in Hamburg.[98] Freight rates for special trains were still dropping or had stabilised on a low level, but also ocean freight rates had declined considerably (see Table 1). Zentgraf even states that after the turn of the century freight rates shifted again to the advantage of British suppliers on the Hamburg market.[99] Furthermore, the price policy of the Rheinisch-Westfälische Kohlensyndikat helped British coal sales to stabilise on the rapidly expanding Hamburg market in the early twentieth century.[100] Table 8 clearly shows that Britain remained the major supplier of coal with market shares fluctuating at around 60%.

The mere import figures do not tell how much of the coal was passed on to other regions. In 1912 nearly two million tons of hard coal were sent to inland consumers by ship.[101] About a quarter of it had been transloaded from the railway to the ship. Hence large quantities of Ruhr coal reached their final destination through rail and water transport combined.[102] 71.6% of the 2 million tons of coal were shipped to the Berlin region. The remaining part was sent to river ports in Sleswig-Holstein, Hanover, Oldenburg, the province and the Kingdom of Saxony and the Mark Brandenburg. Parts of the coal having reached Hamburg on sea-going vessels also left Hamburg on train. In 1912 this amounted to 300.000 tons, 50% of which were sent to Sleswig-Holstein and a third to the province of Hanover and the state of Oldenburg. Less than 1% left for Berlin by train.[103] The proportions put forward by the transport statistics for 1912 are likely to be representative of the transit function of Hamburg during the two decades before World War I.[104] Accordingly, about one third of Hamburg's coal imports were transloaded to be passed on, mainly to the Berlin region.

5.3.2. Magdeburg

Conveniently situated on the river Elbe, Magdeburg moreover was connected with railway trunk lines to all four points of the compass as early as 1847. By then the high price of wood had forced industry and households to use mainly brown and hard coal as fuel.[105] In particular the processing of sugar-beet consumed much fuel, so Magdeburg rapidly became one of the major coal consuming places outside the mining areas.[106] Nearby brown coal collieries competed there against distant suppliers of German, British and Bohemian coal, but around 1850 this local brown coal was still solely used by sugar-beet

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97 Hamburgs Handel 1897: 243 ff.
98 Hamburgs Handel 1897: 242 ff.; Entwickelung 1904: 85 ff.
99 Zentgraf 1913: 495 f.
100 Zentgraf 1913: 500; Krziza 1912: 121 f.; see also the report of the British consul in Parliamentary Papers 1904: 52.
101 Verkehr 1912: P. 2 69. Patent fuel and coke are neglected.
102 Verkehr 1912: P. 1 XXVII; Zentgraf 1913: 460, 497.
103 Güterbewegung 1912: 103. Patent fuel and coke are neglected.
104 Concerning inland waterways and railways these statistics were consistent with each other in 1912 for the first time.
105 Voss 1904: 13.
106 Erläuterungen 1860: 13 ff.

factories located close to the collieries. This brown coal was regarded as inferior and as it was not processed into compact patent fuel, high overland transportation costs confined its market to the locality. Therefore, hard coal from Britain and Saxony as well as brown coal from Bohemia was transported to Magdeburg on ships. To weaken the dependency on foreign coal businessmen in Magdeburg were eager to get Prussian coal from Westphalia. In 1849 they complained about the "foreign" Hanoverian state railway not being willing to agree on special low tariffs.[107] That was grist to the mills of the Westphalian colliery owners and in a pamphlet dated 1858 they recommended increased sales outside the mining area as the only remedy for the expected overproduction of coal. They considered Magdeburg the most important sales market in the east, a place where they had not yet sold any coal.[108]

Although the "Einpfennigtarif" was actually not introduced on this connection until 1862, considerable quantities of coal were already sold there in 1860 and 1861. The then high price of British coal aided these sales, for which the coal was transported on special trains. But as Westphalian coal possessed some unknown properties, there still was a certain preference for British coal, which held back the substitution of Westphalian for British coal. The data compiled by the Prussian Minister of Trade reveal that Westphalian coal from the Ruhr had won a market share of mere 6.3% in 1860 (Table 9). Although British sales actually had dropped by half in 1860 as compared to 1859,[109] British coal still dominated in the market segment for hard coal. The continuing high freight rates on the railway even hindered Westphalian coal from outstripping Saxon hard coal, most of which reached Magdeburg via the Elbe.[110] As the large factories had gradually learned how to use their local brown coal it soon gained an advantage over Bohemian brown coal.[111]

Table 9 shows how rapidly the share of British hard coal declined. Only in 1871 did it recover briefly, which was brought about by favourable business cycle conditions. In 1881 Westphalian coal had driven off nearly all competitors in hard coal, but Bohemian brown coal had gained largely increased market shares. This was probably due to transload facilities (steam cranes) at the Elbe which allowed a speedy reloading from ships into railway waggons since 1878. This improved Magdeburg's transfer functions considerably.[112] During the 1880s British coal disappeared from this market. But in 1890, when prices increased and Ruhr collieries could hardly meet the demand, the gap was closed by hard coal from Saxony, Upper Silesia and once again from Britain. Although this was just a short-term cyclical shortage, British coal featured permanently in the 1890s due to the price policy of the Rheinisch-Westfälische Kohlensyndikat. Although the British market share may not have been very large, the buffer function of British coal with its price-depressing effect was highly esteemed by contemporaries: "This competition has a

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107 Voss 1904: 16 ff.
108 Absatz 1858: 10 ff.
109 Voss 1904: 18 f.
110 Three quarters of the coal took this way, see Erläuterungen 1860: 25.
111 Voss 1904: 18.
112 Voss 1904: 21. The price of brown coal was relatively low during the 1880s.

charitable effect, since undoubtedly the Westphalians would have asked for completely different prices."[113] Unfortunately there are no exact statistics available to document the origins of Magdeburg's coal imports until 1913 and even figures for the total amount of coal which arrived on the Elbe are obscure.[114] Shortly before World War I it is likely that the British market share probably amounted to 10% of the entire hard coal market. This can be concluded indirectly from statistics on 1912. They don't cover the Magdeburg market completely, however, and furthermore they deal with a much larger region than the city of Magdeburg.[115] During the period from 1850 to 1913 the British market shares in Magdeburg followed a u-shaped curve, with a capital U in the first half and a small u in the second half.

5.3.3. Berlin

Berlin is situated at the point of intersection of two rivers, which had already been connected by canals before the beginning of the 19th century. In the 1840s railways improved the city's convenient location even more. With its developing suburbs, Berlin rapidly became Germany's largest and most densely populated industrial city. Without any local coal resources Berlin had to rely on imports from mostly very distant mining areas in order to satisfy its needs for primary energy. Towards the end of the 19th century this locational disadvantage became less severe because transportation costs had declined. Suppliers from different mining areas competed with each other in Berlin, which thus suffered less than many other regions in Germany from the price policy of cartels.

But in the middle of the 19th century the lack of locally available coal resources was still a severe handicap. Transportation costs then were so high that even as late as 1860 wood and peat were the major fuels for domestic use.[116] During the early 1840s Berlin had imported far more wood than hard coal, measured in quantities. Hard coal came exclusively from Great Britain.[117] Transported via Swinemünde/Stettin (Baltic Sea) and inland waterways, most of it was used to produce coke and town gas as well as smithy coal. Upper Silesian hard coal arrived there for the first time in 1848. This coal probably had a share of barely 10% in the estimated 200.000 tons of hard coal consumed in 1853.[118] The available information, although scanty, suggests that the consumption of coal increased very fast from 1840. Apart from hard coal, Berlin also imported much brown coal. More than 6% of the about 73.000 tons consumed in 1853 came from Bohemia by ship.[119]

Better data are available from 1860 onwards (see Table 10).[120] The tendency in

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113 Voss 1904: 24 ff., quotation on p. 26.
114 Voss 1904: 33; Verkehr 1912: P. 2 VII.
115 I have used these statistics already for the case study of Hamburg. For further details, see Fremdling 1989. My calculations are based on Verkehr 1912: P. 2 181, 170; Güterbewegung 1912: 213 f.
116 Erläuterungen 1860: 13.
117 Berlin 1896: 355 ff.
118 Zentgraf 1913: 450 ff.
119 Zentgraf 1913: 452.
120 The source used for Table 10 also discriminates between water and rail transportation.

the long run is clearly visible: British coal, which reached Berlin almost exclusively by ship, lost considerable market shares until 1881 and Upper Silesian coal profited heavily from this loss. Except for 1860, most of the coal was transported by railway. Coal from both Upper and Lower Silesia was able to gain increasing market shares because the railway had reduced its freight rates drastically. Whereas Saxon hard coal hardly achieved much significance, after initial difficulties Westphalian coal even outstripped British coal in 1881, reaching Berlin by railway. Except for 1871, German brown coal held a high market share. Bohemian brown coal increased its market shares both in 1871 and 1881 considerably. In those years it was partly transported on inland waterways but the last section was covered on rail.

In the late 1870s contemporaries believed that British hard coal would disappear completely from the Berlin market.[121] As shown in Tables 11 and 12, however, it recovered until 1913: British coal increased its market share from just over 5% in 1881 to about one quarter shortly before World War I. This strong recovery was due both to the unfavourable price policy of the German coal cartels and to the favourable development of water freight rates compared to those of the railway. The market shares of both Silesian mining areas suffered a relative decline in those late years, but in absolute terms Silesia now as before delivered most of the hard coal to Berlin. Ruhr coal finally did gain a footing in the Berlin market. Concerning other German mining areas, it was mainly their patent fuel (brown coal) which won extraordinary market shares. Bohemian brown coal, which had done well in the 1870s and 1880s, could not stand up to this competition and was nearly pushed out of the Berlin market before World War I. In the early 20th century Berlin was the major consumer of coal outside the coal fields and at least[122] five different mining districts competed there against each other.

5.3.4. Synopsis on Northern Germany

The analysis of regional coal markets in northern Germany revealed clear-cut developments in the long run. In the middle of the 19th century hard coal from Great Britain predominated, frequently being the only supply at all. Declining transportation costs of overland haulage by rail allowed suppliers from German mining areas to penetrate these markets and by the 1880s they had succeeded in undermining the British predominance. British suppliers even seemed to have disappeared from some markets for good. But this trend was broken: up to 1913 British coal recovered strongly without ever regaining its former preponderance. There were two main reasons for the British recovery: first, freight rates on sea and inland waterways declined lower than those on railways and second, cartelisation tended to raise the prices of German coal immoderately compared to those for British coal.[123]

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121 Zentgraf 1913: 452.

122 One could further differentiate various German brown coal producing areas and British hard coal districts.

123 On this point, however, I have not yet gathered any quantitative evidence.

For 1913 the competitive relation between British and German coal can be described by the following figures:[124]

British coal mark per ton		German coal mark per ton	
price at pit mouth			
Durham gas best unscreened	13.45	Rhenish-Westphalian gas slack[125]	14.50
		Upper Silesian gas slack	14.40
freight rates			
Tyne-Hamburg	3.85	Gelsenkirchen-Hamburg	5.60
Tyne-Bremen	4.10	Gelsenkirschen-Bremen	4.50
Tyne-Stettin	5.49	Gelsenkirschen-Stettin	7.40
costs of transloading			
ship to railway		0.70	
ship to ship		0.50	
railway to ship		0.30	
local prices			
Hamburg	17.60-18.00	Hamburg	19.70-20.10
Bremen	17.85-18.25	Bremen	18.60-19.00
Stettin	19.24-19.64	Stettin	21.40-21.80

6. Conclusion

The industry of the 19th century was widely based on coal-consuming techniques, to be sure. Hence, those regions poorly endowed with coal did start with a handicap. They could overcome it through importing coal it is true, but -ceteris paribus- the higher price of coal still made industries outside the mining areas less competitive. Nevertheless, the lack of local coal was not altogether prohibitive for a successful industrialisation, as several cases show. After all indigenous coal resources did not in any case guarantee cheap supplies, for a successful cartelisation could rise the price well above competitive levels. But lowered transportation costs enabled some regions to draw on the coal resources of competitive mining areas and thus avoid the price rising policies of cartels. So from the start neither the lack of local coal resources nor the dependency on powerful indigenous suppliers debarred a region from industrialisation if transportation was cheap enough to overcome these locational disadvantages.

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124 Regul 1933: 80.

125 In German: Gasförderkohle.

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Table 1. Freight Rates for Coal Shipments from Britain[1], 1850-1913, in shillings per ton

Year	to Hamburg/Le Havre	to Danzig	to Bordeaux	to Genoa	to South-America
1850/54	9.7	10.3	11.8	19.4	-
1855/59	10.0	11.7	14.7	26.6	52.0
1860/64	9.2	10.3	14.0	23.6	36.8
1865/69	8.3	9.3	12.6	19.5	32.6
1870/74	8.7	9.2	10.5	17.2	30.0
1875/79	7.3	9.1	9.3	13.9	23.4
1880/84	6.3	8.3	7.8	12.8	23.3
1885/89	4.8	5.9	6.4	10.3	22.4
1890/94	4.7	4.8	4.8	7.5	16.8
1895/99	4.4	4.4	4.6	8.0	13.8
1900/04	4.3	4.8	4.3	7.0	11.8
1905/09	3.8	4.4	4.1	6.5	11.2
1910/13	4.3	5.4	5.3	8.8	17.1

Source: Calculated from Harley 1989: 334-336.

[1] Various ports.

Table 2. British Exports of Hard Coal, 1853-1913, five years averages in per cent.

Country/Region	1853-57	1858-62	1863-67	1868-72	1873-77	1878-82	1883-87	1888-92	1893-97	1898-02	1903-07	1908-12/13
Russia	3.1	5.0	5.6	6.5	6.3	7.5	6.1	5.3	5.5	6.4	5.2	6.0
Sweden/Norway	4.2	4.4	4.5	5.2	7.1	7.0	7.4	8.0	9.1	10.0	9.4	9.5
Denmark	7.9	6.5	5.8	5.6	5.0	4.9	5.0	4.8	5.0	5.0	4.8	4.5
Germany	15.5	15.7	14.5	15.2	14.3	12.0	11.6	12.5	13.2	13.3	14.7	14.0
Netherlands	3.9	3.9	2.6	3.3	3.2	2.5	1.5	1.7	1.8	2.8	3.8	3.3
Belgium	0.4	0.7	0.7	1.0	2.0	1.4	1.3	1.5	1.0	1.7	1.9	2.6
France	19.7	19.3	18.3	17.8	19.1	19.6	18.5	16.5	15.8	17.3	15.7	16.3
Portugal/Azores/Madeira	1.8	1.5	1.7	1.6	1.8	1.8	1.8	2.0	1.9	1.9	1.9	1.8
Spain/Canary Islands	3.6	5.2	4.9	4.0	4.0	4.3	4.8	5.6	5.8	5.2	4.8	4.6
Italy	2.4	4.2	5.8	6.0	6.9	8.2	11.1	12.2	13.0	12.7	13.6	14.0
Austria	1.4	1.3	0.7	0.3	0.5	0.3	0.3	0.3	0.6	0.5	1.2	1.5
Rest of Europe	6.3	4.6	4.3	3.3	4.0	5.6	5.9	5.2	4.3	3.5	3.0	3.0
Europe	70.2	72.5	69.6	69.7	74.3	75.0	75.3	75.8	76.9	80.4	80.0	81.0
Egypt	1.2	1.4	3.4	3.6	3.9	3.8	4.9	5.4	5.1	4.8	4.7	4.3
Rest of Africa	1.1	0.8	1.5	0.1	0.6	2.1	2.1	2.7	3.2	3.7	3.1	2.7
Turkey	5.1	2.6	2.1	2.3	1.8	1.6	1.5	1.5	1.5	1.0	0.9	0.7
India	3.2	3.0	4.5	3.9	4.8	5.1	5.4	4.3	3.2	1.5	1.1	0.8
Rest of Asia	1.7	2.1	2.6	1.1	1.7	1.7	1.4	1.2	1.1	1.0	1.1	0.5
USA	3.8	4.2	2.1	1.0	0.9	1.2	1.0	0.6	0.5	0.6	0.6	.0
Canada	1.9	2.0	2.0	1.8	1.2	0.9	0.5	0.3	0.3	0.2	0.2	0.1
Central America	4.4	4.2	5.1	3.6	3.1	2.8	1.9	1.2	1.0	0.4	0.5	0.2
Chili	1.0	0.8	1.1	1.0	1.3	1.0	0.6	0.8	0.9	0.7	0.9	1.0
Brasil	1.8	2.0	2.2	2.5	2.5	2.0	2.0	2.4	2.6	2.1	2.1	2.4
La Plata-Region	0.0	0.6	1.2	1.8	1.2	1.3	2.3	3.0	3.4	3.3	4.6	6.0
Rest of South America		0.3	0.2	0.6	0.8	0.8	0.8	0.5	0.3	0.2	0.1	0.10
America	13.2	14.1	14.3	12.5	11.1	10.0	8.9	8.7	8.9	7.4	8.9	9.8
Australia,New Zealand, Pacific Islands	0.9	0.5	0.3	0.0	0.0	0.0	0.0	.0	.0	.0	.0	.0
Other Countries	3.5	3.0	1.8	6.8	1.7	0.7	0.6	0.4	0.1	.0	0.2	0.2
Total (metric tons)	5032045	7261365	9177838	11553735	14226455	17818577	22780126	28534745	32428068	41731913	52404256	66258503

Source: Computed from yearly data in the British foreign trade statistics, see Parliamentary Papers 1854/55 ff.

Table 3. French Imports of British Coal, 1841-1913, in five years averages

Years	1000 metric tons	as % share of total imports	as % share of total consumption
1841/45	476	24	9
1846/50	576	24	8
1851/55	702	19	7
1856/60	1.236	22	9
1861/65	1.392	21	8
1866/70	1.854	24	9
1871/75	2.240	30	10
1876/80	3.012	35	12
1881/85	4.032	37	14
1886/90	4.156	40	13
1891/95	4.805	42	13
1896/00	6.232	48	16
1901/05	7.181	49	15
1906/10	10.235	53	19
1911/13	11.107	49	18

Source: Crouzet 1966: 178.

Table 4. Regional Distribution of the Consumption of British Coal in France, 1838-1911, in per cent of total consumption

Regions	1838	1867	1879	1892	1900	1911
Maritime Normandy	62	80	87	78	81	66
Brittany	66	80	90	92	96	84
Maritime South-West	95	77	88	82	91	84
Pas-de-Calais	9	10	14	7	12	8
Mediterranean Coast	-	-	5	21	16	25
Paris Region	9	12	12	11	11	24
Interior West	8	37	64	74	77	75
Middle Loire Region	10	20	41	28	26	33
Central West	69	60	58	54	53	59
Interior Aquitaine	-	-	21	18	26	34

Sources and notes: Crouzet 1966: 192.

Maritime Normandy: Seine-Inférieure, Eure, Calvados, Manche.
Brittany: Ille-et-Vilaine, Côtes-du-Nord, Finestère, Morbihan,Loire-Inférieure.
Maritime South-West: Vendée, Charente-Inférieure, Gironde, Landes, Basses-Pyrénées.
Mediterranean Coast:Alpes-Maritimes, Var, Bouches-du-Rhône,Gard, Aude, Pyrénées-Orientales, Corse.
Interior West: Orne, Sarthe, Mayenne, Maine-et-Loire.
Paris Region: Seine, Seine-et-Oise.
Middle Loire Region: Indre-et-Loire, Loir-et-Cher, Loiret, Eure-et-Loir.
Central West: Vienne, Deux-Sèvres, Charente, Haute-Vienne.
Interior Aquitaine: Dordogne, Lot-et-Garonne, Gers, Haute-Garonne, Hautes-Pyrénées.

Only those départements are registered here where British coal was sold regularly and in noticeable quantities.

Table 5. Import and Export of Hard Coal of the Netherlands, 1870-1914, five years averages

Years	Import				Export				Net Import
	total 1000 metric tons	from Great Britain %	from Belgium %	from Germany %	total 1000 metric tons	to Great Britian %	to Belgium %	to Germany %	1000 metric tons
1870/74	2,091	21.7	18.5	59.7	272	0.1	70.7	22.4	1,819
1875/79	2,943	15.2	10.5	74.2	618	0.1	90.0	7.8	2,325
1880/84	4,346	10.7	6.7	82.5	1,287	0.0	94.6	4.4	3,060
1885/89	4,945	7.1	8.0	84.9	1,309	0.0	89.8	7.1	3,636
1890/94	5,803	9.2	8.2	82.4	1,792	0.2	87.0	6.5	4,011
1895/99	7,277	12.4	9.7	77.9	2,822	0.2	82.7	8.4	4,455
1900/04	10,141	11.1	7.3	81.0	5,164	0.2	78.6	9.4	4,978
1905/09	14,825	17.3	6.1	76.4	8,851	0.3	71.8	15.2	5,974
1910/14	22,278	9.3	3.0	86.7	15,179	0.5	72.0	8.2	7,100

Source: Computed from Bos 1978: 362f.
Note: Transit trade is included.

Table 6. Output of Hard Coal in German Mining Districts, 1860-1912, in per cent

Districts	1860	1872	1881	1890	1900	1912
Lower Rhenish-Westphalian	34.8	43.2	48.8	50.6	55.0	58.8
Aachen	5.0	3.1	2.5	2.1	1.6	1.8
Saar (including Bavarian Rhenish Palatinate, Lorraine[1] and Baden)	17.3	14.1	12.2	10.6	10.2	9.3
Saxon	12.8	8.8	7.0	5.5	4.4	2.9
Lower Silesian	6.2	6.4	5.6	4.6	4.4	3.2
Upper Silesian	19.8	21.8	21.4	24.0	22.7	23.5
Other	4.1	2.6	2.9	2.6	1.7	0.5
Total (in 1.000 metric tons)	12,533.7	33,306.4	48,688.2	70,237.8	109,225.0	174,875.3

1) 1860 without Lorraine, which Schulz includes.

Sources: Schulz 1911: Table I. and III.; Flegel/Tornow 1915: 122-129.

Table 7. Freight Rates for Coal Transportation on Waterways to Berlin, 1898-1909, in mark per metric ton

Year	from Hamburg	from Stettin	from Breslau	from Kosel(Oder)
1898	4.95		4.00	6.15
1899	2.95		3.65	5.90
1900	4.15		4.05	5.95
1901	4.25		4.15	6.75
1902	3.75		3.45	5.50
1903	3.95		3.20	5.65
1904	4.50		4.20	6.00
1905	3.30	2.85	3.30	5.80
1906	2.85		3.15	5.50
1907	3.15		3.15	5.40
1908	2.70	2.75	3.10	5.30
1909	3.20	2.75	3.35	5.65

Source and notes: Zentgraf 1913: 494 f.
Costs of transfer and insurance are included.
These average rates are but a rough indicator, even in a normal year they could vary between 1.80 and 5 marks.

Table 8. Coal Imports of Hamburg, 1894-1911

Year	British %	German %	Total 1000 metric tons
1894	58.2	41.8	2,853
1895	56.2	43.5	2,981
1896	56.0	44.0	3,208
1897	59.8	40.2	3,608
1898	55.4	44.6	3,707
1899	59.5	40.5	4,066
1900	65.3	34.6	4,622
1901	60.8	38.9	4,430
1902	61.0	38.8	4,577
1903	62.1	37.9	4,942
1904	59.0	41.0	4,889
1905	64.3	35.7	5,525
1906	61.8	38.2	6,070
1907	66.9	33.1	7,417
1908	63.1	36.9	7,842
1909	65.9	34.1	7,958
1910	61.9	38.1	8,400
1911	59.4	40.6	7,973

Source and notes: 1894-1903, Parliamentary Papers. Vol. 16, 1905: 884;
1904-1911, Zentgraf 1913: 502.
Between 1900 and 1902 small quantities of American coal reached Hamburg. For the overlapping years (1900/1903) Zentgraf gives slightly different figures.

Table 9. Coal Imports into Magdeburg, 1860-1881 in per cent

Type of coal	1860	1862	1865	1871	1881
British hard coal	25.7	17.4	5.7	18.1	1.0
Westphalian hard coal	6.3	18.2	35.6	20.9	19.9
Bohemian brown coal	24.5	19.9	15.8	26.3	44.8
Local brown coal	34.2	36.5	38.4	27.4	31.1
Saxon hard coal	8.2	6.3	3.7	5.5	1.4
Bohemain hard coal	1.1	1.4	0.3	-	-
Upper Silesian hard coal	-	0.3	0.4	0.6	0.4
Lower Silesian hard coal	-	-	-	-	0.0
Hanoverian hard coal	-	-	-	0.3	1.4
Local hard coal	-	-	-	0.9	-
Total (1.000 metric tons)	395.1	408.7	544.4	622 .4	945.1

Source: Erläuterungen. 1860: 25f.; 1862: 38; 1865: 45f.; 1871: 37f.; 1881: 41.

Table 10. Coal Imports of Berlin and adjoining Factory Districts, 1861-1881

Year		1860	1862	1865	1871	1881
British hard coal	%	57.4	41.9	20.6	23.0	4.9
Saxon hard coal	%	0.6	2.1	1.1	0.3	0.9
Upper Silesian hard coal	%	18.5	32.1	53.9	52.4	49.8
Lower Silesian hard coal	%	7.8	6.4	6.6	11.0	9.1
Westphalian hard coal	%	-	3.2	4.7	1.1	6.2
Hanoverian hard coal	%	-	-	-	-	0.2
Bohemian brown coal	%	2.8	2.3	3.6	6.1	16.3
German Brown coal	%	12.8	11.9	9.4	6.1	12.7
Total (1.000 metric tons)		354.2	431.7	652.4	1,073.1	1,545.7

Source: Erläuterungen. 1860: 37; 1862: 37f.; 1865: 42f.; 1871: 33ff.; 1881: 37f.

Table 11. Coal Consumption of the City of Berlin, 1881-1911

Year	Hard Coal, Coke, Patent Fuel					Brown Coal, Patent Fuel			Total
	British	Westphalian	Lower Silesian	Upper Silesian	Saxon	Bohemian	Prussian and Saxon		1000 metric tons
	%	%	%	%	%	%	%		
1881	5.1	6.4	9.4	50.0	1.6	13.1	13.7		1,029
1882	6.4	6.8	10.1	50.0	0.5	10.9	15.2		1,024
1883	6.4	5.3	9.3	49.6	0.8	10.9	17.7		1,022
1884	7.5	4.9	8.8	48.6	0.6	10.1	19.4		1,065
1885	6.6	4.5	9.0	48.3	0.5	11.2	19.9		1,139
1886	6.7	4.2	9.3	48.5	0.4	9.0	21.9		1,191
1887	5.9	3.9	9.8	47.6	0.2	9.2	22.2		1,203
1888	5.8	4.2	9.0	47.3	0.1	10.2	21.8	1.5	1,292
1889	5.6	4.4	9.0	47.0	0.1	9.8	23.1	1.0	1,320
1890	5.0	4.0	9.2	48.3	.0	8.4	24.1	1.0	1,407
1891	6.9	3.9	7.1	45.0	0.2	8.9	27.2	0.8	1,332
1892	5.1	3.7	9.1	42.3	0.4	8.7	30.1	0.7	1,270
1893	7.6	3.5	9.0	43.8	0.4	7.3	27.7	0.7	1,420
1894	8.6	3.9	9.5	43.9	0.6	5.7	27.1	0.7	1,458
1895	9.2	4.5	9.1	39.7	0.5	5.0	29.9	1.0	1,427
1896	13.1	5.8	8.7	37.2	0.3	4.1	30.1	0.8	1,635
1897	12.5	7.3	8.0	37.6	0.3	3.7	29.9	0.7	1,689
1898	11.3	7.0	8.2	40.4	0.2	3.0	29.4	0.5	1,693
1899	9.2	8.6	9.6	39.5	0.1	2.5	30.0	0.6	1,707
1900	12.9	6.5	7.8	36.7	0.1	1.7	34.0	0.4	1,793
1901	14.4	5.9	7.8	36.5	0.2	1.4	33.3	0.5	1,948
1902	11.8	6.1	8.3	36.5	0.6	0.8	35.1	0.3	1,762
1903	11.8	6.2	9.3	37.2	0.3	0.6	34.3	0.3	1,875
1904	14.6	5.5	10.1	30.7	0.3	0.8	37.7	0.2	1,819
1905	17.5	6.0	6.5	32.9	0.2	0.8	35.9	0.3	2,045
1906	14.5	7.7	5.5	33.8	0.2	1.0	37.2	0.2	2,037
1907	20.2	7.7	5.6	31.1	0.2	0.8	34.2	0.1	2,332
1908	22.5	7.2	4.9	26.9	0.3	0.3	37.7	0.2	2,228
1909	25.4	7.9	4.2	25.9	0.3	0.2	36.2	0.1	2,372
1910	25.2	8.5	5.0	25.9	0.1	0.1	35.0	0.1	2,159
1911	24.4	7.9	5.3	23.3	0.8	0.1	38.0	0.1	2,062

Source and notes: Zentgraf 1913: 453.
Since 1888 Prussian and Saxon brown coal are split up in patent fuel and other coal.

Table 12. Coal Imports of Berlin and her Suburbs, 1904-1913

Year		1904	1905	1906	1907	1908	1909	1910	1911	1912	1913
British hard coal	%	13.9	15.0	13.0	19.2	22.2	24.2	24.7	24.7	20.3	24.6
Saxon hard coal	%	0.8	1.0	0.3	0.3	0.3	0.3	0.2	0.7	1.0	0.3
Upper Silesian hard coal	%	33.5	36.3	38.6	35.0	32.9	31.2	32.0	28.5	35.9	29.5
Lower Silesian hard coal	%	10.4	7.9	6.1	5.2	4.2	3.8	4.5	4.8	4.8	5.2
Westphalian hard coal	%	5.8	6.0	7.8	8.4	6.9	8.4	8.1	7.2	6.8	7.9
Bohemian brown coal	%	0.8	0.8	1.0	0.8	0.6	0.5	0.4	0.5	0.4	0.4
German brown coal	%	0.5	0.4	0.5	0.5	0.3	0.1	0.1	0.3	0.2	0.2
Patent fuel (brown coal)	%	34.3	32.5	32.8	30.6	32.7	31.6	30.0	33.3	30.6	31.9
Total (1000 metric tons)		4,328.9	4,870.6	5,082.7	5,689.0	5,831.5	6,150.9	5,739.0	5,719.2	7,010.8	6,719.7

Source: Berliner Jahrbuch. 1906: 181; 1907: 203; 1908: 199; 1909: 182; 1910: 198; 1911: 215; 1912: 207; 1913: 213.

Table A1. Freight Rates for Coal Shipments from Cardiff to Various Ports, 1872-1909/11, in shillings per ton and per 100 kilometres

Ports of Destination	1872	1873	1875	1888	1890	1892	1893	1898	1900	1901	1902	1905/07	1909/11
Group 1: Mediterranean and European Atlantic	0.58	0.67	0.55	0.39	0.36	0.33	0.28	0.36	0.40	0.28	0.25	0.24	0.26
Group 2: Baltic and North Sea	0.57	0.69	0.62	0.42	0.43	0.27	0.23	0.39	0.40	0.28	0.26	0.25	0.22
Group 3: East African	0.33	0.38	0.30	0.26	0.19	0.13	0.12	0.15	0.23	0.15	0.12	0.11	0.10
Group 4: West African	0.36	0.44	0.37	0.25	0.17	0.29	0.33	0.36	0.16				
Group 5: South African	0.19	0.27	0.21	0.31	0.12	0.20	0.25	0.18	0.14	0.11			
Group 6: Continental Indian	0.23	0.27	0.19	0.19	0.13	0.09	0.08	0.12	0.18	0.11	0.09	0.09	0.08
Group 7: Asian Far Eastern	0.20	0.21	0.17	0.16	0.13	0.09	0.08	0.13	0.16	0.11	0.08	0.08	0.06
Group 8: South American Atlantic	0.27	0.35	0.23	0.32	0.26	0.13	0.10	0.15	0.16	0.12	0.10	0.12	0.13
Group 9: West Indian	0.25	0.26	0.17	0.20	0.14	0.10	0.10	0.13	0.19	0.11	0.11	0.12	0.11
Group 10: American Pacific	0.18	0.19	0.12						0.08	0.08	0.06	0.11	0.09
Total Average	0.53	0.62	0.53	0.38	0.34	0.27	0.23	0.34	0.37	0.26	0.23	0.22	0.22

Sources and notes on Table A1: 1872-1902, Thomas 1903: 505 ff.; 1905/07, Jevons 1909: 13; 1909/11, Jevons 1915: 685 f.

The freight rates are standardized per 100 kilometre. For each group there are unweighted averages given, and the total average is weighted by the shipped quantities in 1902. For the quantities see Thomas, Growth, p. 510.

Name of the ports (Distance from Cardiff in nautical miles):

Group 1 : Alexandria (2,943), Barcelona (1,664), Bilbao (560), Bordeaux (542), Cape de Verdes (2,408), Dieppe (417), Genoa (2,020), Gibraltar (1,153), Havre (382), Lisbon (882), Malta (2,133), Marseilles (1,844), Odessa (3,272), Piraeus (2,616), Port Said (3,072), Rouen (420), Trieste (2,806), Venice (2,800).

Group 2 : Antwerp (558), Cronstadt (1,776), Hamburg (821), Stockholm (1,498).

Group 3 : Aden (4,489).

Group 4 : Sierra Leone (2,885).

Group 5 : Cape Town (5,998).

Group 6 : Bombay (6,154).

Group 7 : Colombo (6,606), Hong Kong (9,716), Shanghai (10,466), Singapore (8,186), Yokohama (11,094).

Group 8 : Buenos Ayres (6,249), Monte Video (6,139), Rio Janeiro (5,027).

Group 9 : Havanna (4,025), Jamaica (4,034), St. Thomas (3,525).

Group 10 : Iquique - via Cape Horn (9,623), Iquique - via Isthmus (6,830), San Francisco - via Cape Horn (13,606), San Francisco - via Isthmus (8,175), Valparaiso - via Cape Horn (8,869), Valparaiso - via Isthmus (7,588).

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